STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT & CONSERVATION
Division of Radiological Health
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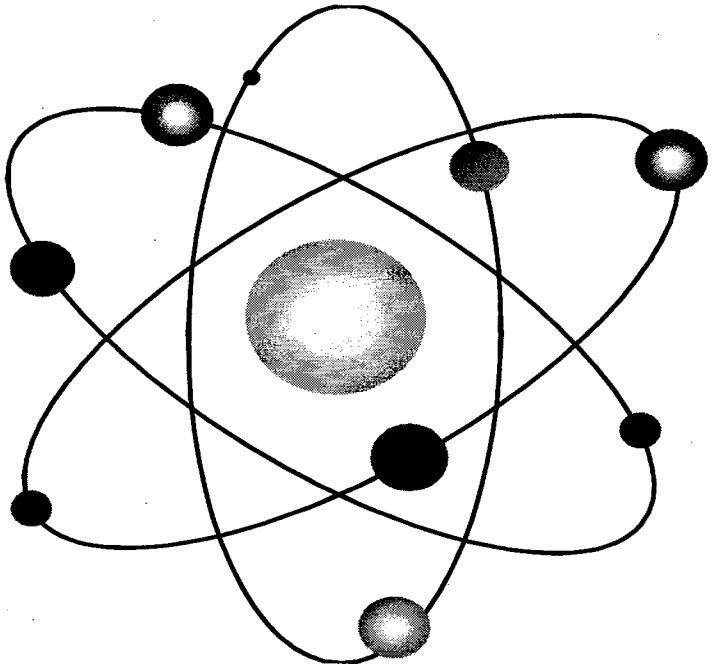

GUIDE
FOR
COMPLETING APPLICATION
FOR RADIOACTIVE MATERIAL LICENSE (RHS 8-5R)
FOR
INDUSTRIAL RADIOGRAPHY

(JANUARY 2002)

GUIDE FOR COMPLETING APPLICATION FOR RADIOACTIVE MATERIAL LICENSE (RHS 8-5R) FOR INDUSTRIAL RADIOGRAPHY

(January 2002)

INDUSTRIAL RADIOGRAPHY INSTRUCTIONS FOR PREPARATION OF FORM RHS 8-5R

An applicant for a Tennessee Radioactive Material License to possess and use radioisotopes in the form of sealed sources for radiography must complete Form RHS 8-5R and must attach to the completed form the additional information indicated. Two copies of the complete application should be sent to the Division of Radiological Health, Tennessee Department of Environment & Conservation, 3rd Floor L&C Annex, 401 Church Street, Nashville, TN 37243-1532. The applicant may refer to Tennessee State Regulations for Protection Against Radiation (SRPAR) at http://www.state.tn.us/sos/rules/1200/1200-02/1200-02.htm or by purchasing a copy from the Division of Radiological Health (615 532-0364) to assist in preparation of the application.

EXPLANATION OF FORM RHS 8-5R

SRPAR designates "State Regulations for Protection Against Radiation"

Notice: Pages of your application must be numbered to provide for easy reference. Also, all attachments to your application must be keyed to the application form by page number.

Item 1. (a) Identify the legal entity in whose name the license should be issued who is to be legally responsible for possession and use of the sealed sources of radioactive material. Provide the mailing address.

(b) Check appropriate block indicating organizational structure of applicant.

Item 2. List previous radioactive material licenses by number. If the application is for renewal of an existing license, the license number should be included and the word "renewal" inserted.

Item 3. Specify the address at which the sealed sources will be used and/or stored. If sources are to be used for more than 30 days (any radiographic work performed during any 24 hour period shall constitute one (1) day), applicable requirements of SRPAR, 1200-2-5-.80 must be met and the required information submitted in Item 6.a. If sources are to be used only at "temporary jobsites" as defined in SRPAR 1200-2-8-.03, please so specify.

Item 4. The sealed sources including calibration sources that the applicant will possess and use should be listed by radioisotope, manufacturer (or distributor), and model number. The maximum amount of radioactivity in each source should be specified. The number of sources that the applicant will possess at any one time need not be specifically stated.

Item 5. Radiographic exposure devices and source changers should be designated by manufacturer (or distributor) and model number and should be keyed alphabetically to the sources listed in Item 4 with which they will be used. Any depleted uranium utilized as shielding material in exposure devices or source changers should be listed. Depleted uranium (999 kilograms) will be authorized to allow the applicant to possess adequate shielding material. Radiographic exposure devices and associated equipment must meet the requirements specified in SRPAR 1200-2-8-.04(10).

If necessary, the suppliers of equipment should be contacted concerning the model numbers of sources, devices, and source changers to ensure that the information contained in the application is accurate. Improperly identified equipment may require additional correspondence.

Item 6(a). This item applies only to permanent radiographic installations as defined in SRPAR 1200-2-8-.03. A facility is considered "permanent" if it is intended to be used for radiography, even if radiography is rarely performed there. All radiographic operations conducted at specific locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized otherwise by the Department. If a permanent radiographic installation will be used for performance of radiography, a detailed description of the installation that includes the following information should be submitted.

a. Annotated drawings or sketches of the installation and its surroundings, including (1) dimensions of each enclosed area; (2) thickness, density, and type of shielding material on all sides, above and below; (3) identification of entranceways; and (4) a description of the general location of the installation including current uses of surrounding areas; and (5) distances to all areas adjacent to, above, and below each exposure area.

b. A description of the area security safeguards, such as locks, signs, warning lights and alarms, and interlocking systems for each enclosed exposure area and adjacent areas. Particular attention should be given to the description of the high radiation area entrance controls that are required by SRPAR 1200-2-5-.80(1).

c. The results of calculations or radiation level measurements showing maximum anticipated radiation levels in all areas adjacent to each exposure area including the roof or ceiling. As a basis for calculations, the type of source, quantity of activity in the source, and position of the source within the installation should be identified.

Particular attention should be given to radiation levels on the roof of the installation. If those levels may exceed 2 millirem per hour, the application should show how access to the roof will be controlled. If the calculations or measurements show that radiation levels on the roof might exceed 100 millirem per hour, the applicant should consider the use of collimating devices or additional shielding in the roof or ceiling.

A properly shielded installation will permit the performance of radiography within the facility with the areas outside the facility considered as unrestricted areas if they meet the radiation level limitations in SRPAR 1200-2-5-.60(l)(b). A radiation level of not more than 2 millirems per hour at a distance of 12 inches from an external surface of the facility will be considered acceptable for considering the area as an unrestricted area. The licensee is also required to conduct operations such that the dose to individual members of the public does not exceed 100 mrem (1 mSv) in a year. Reasonable occupancy factors may be used in demonstrating compliance with this limit.

Item 6(b). Confirm that you will maintain sufficient calibrated and operable radiation survey instruments for surveys are required by SRPAR 1200-2-8-.04(4). These survey instruments shall have a range such that two millirems (0.02 millisievert) per hour through one rem (.01 sievert) per hour can be measured.

Item 6(c). SRPAR 1200-2-8-.04(4) requires that radiation survey instruments used in radiographic operations be calibrated at intervals not to exceed 6 months and after each instrument servicing, except for battery changes. Appendix A contains a description of an acceptable procedure for calibrating survey instruments.

If an applicant wishes to calibrate his or her own instruments, the following information should be submitted:

a. The type (radioisotope, manufacturer, and model number) and activity of any source to be used for calibration.

b. The accuracy of the source. Accuracy is the maximum deviation of the nominal value of the source from the true value. This information is normally provided by the manufacturer.

c. The specific procedures to be used for calibration including radiation safety procedures to be followed for use of the source.

d. The name and pertinent experience of each individual who will perform instrument calibration. This information may be omitted if the individual is a radiographer and the applicant has an adequate program for the training of radiographers (see 6(f)) that includes instrument calibration

procedures. If radiographers will perform instrument calibration, specific instructions and procedures should be written for use by radiographers and should be included in the operating and emergency procedures (see 6(e)).

If instrument calibration will be performed by an organization other than the applicant, the applicant should confirm that the organization is licensed to perform this service by the U. S. Nuclear Regulatory Commission or an Agreement State.

Item 6(d). The applicant should confirm that individuals performing industrial radiography will use personnel monitoring as required in SRPAR 1200-2-8-.05(3)(a). The use of optically stimulated luminescent dosimetry is acceptable.

Item 6(e). The applicant should describe the operating and emergency procedures that will be followed by radiography personnel. Appendix B describes items and procedures that should be included.

Item 6(f).The applicant shall provide a description of the training program for radiographers, and radiographer's assistants as required by SRPAR 1200-2-8.10(1). Also refer to SRPAR 1200-2-8-.05 and 1200-2-8-.07 for training requirements and subjects to be covered. Effective July 1, 2002, the applicant need not describe its initial training and examination program for radiographers in the subjects outlined in 1200-2-8-.07(7), but must ensure training on these subjects. The submitted description shall also include annual refresher training, on-the-job training, and means to be used by the licensee to determine the radiographer's and radiographers assistant's ability to comply with Division regulations, licensing requirements, and operating and emergency procedures. Appendix C describes the elements of an acceptable training program and what shall submitted for DRH approval.

The name, training, and experience with radiation of each person who is to participate in the instruction, examination, or qualification of trainees should be given in sufficient detail to establish his or her qualifications to perform these services. If an individual will teach only certain parts of the course, this should be specified. Individuals who provide instruction in the hands-on use of radiography equipment should be certified radiographers with at least 1 year experience in performing radiography, or should possess a thorough understanding of the operation of radiographic equipment (e.g. a manufacturer's service representative).

Item 6(g). The applicant should provide a description of the internal inspection system for controlling the receipt, possession, and use of radioactive material. The description should show how the system ensures that license conditions, State regulations, and operating and emergency procedures are followed by radiographers and radiographer's assistants as required by SRPAR 1200-2-8-.10(3).

Other management controls, including a description of (1) the qualifications of each person responsible for maintaining such control, (2) the type of internal inspections to be made and their frequency, (3) the responsibilities of each person to the program, (4) the procedure for recording and reporting deficiencies to appropriate management personnel, and (5) the education and follow-up program to be used in correcting deficiencies noted during inspections should be specified in the application. The type and extent of the radiography program to be conducted will usually determine the nature of the system and the inspection frequency. Internal inspections should not exceed six month intervals.

Internal inspections, including evaluation of each radiographer, should be made by a person of authority in management. These inspections may be announced or unannounced as necessary to ensure compliance. This person should have a thorough knowledge of equipment, procedures, and regulations and level of competence at or above that expected of a radiographer. Management should make a continuing review of quarterly inventories, utilization logs, records of receipt and disposal of licensed material, personnel monitoring results, and surveys.

Item 6(h). SRPAR 1200-2-8-.10(4) requires that the license applicant submit a description of the overall organizational structure pertaining to the radiography program, including specific delegations of authority and responsibility for the program. The applicant should describe how active control over the radiography program is exercised by management personnel in positions of authority. Each individual in the line of authority should be identified by name and title. In addition, the applicant should provide the name, training, and experience of that individual in management who will be assigned duties established by the licensee for maintaining an active management control of the radiation program and radiographic operations. Appendix D describes acceptable qualifications for such individuals and the responsibilities of the positions. If persons of lesser authority will assume some of the duties and responsibilities normally reserved for management, the application should identify those persons and specify how management will ensure that their duties are properly performed.

Item 6(i). The applicant should submit a description of the leak testing program for the sealed sources as follows:

a. If the services of a consultant or commercial organization licensed by this State, the U.S. Nuclear Regulatory Commission or another Agreement State to take the necessary test samples (smears), evaluate the samples, and report the results to the customer are used, the name, address, and license number of the consultant or commercial organization should be specified.

b. If the applicant wishes to be licensed by the State to use a commercially available leak-test kit, the application should identify each kit to be used by designating the kit supplier and the kit model number. Only leak-test kits that are identified will be authorized. The application should also identify the individuals who will perform the leak test (using the kit).

c. If an applicant wishes to be licensed by the State to perform leak tests, including taking and evaluating the smears, SRPAR 1200-2-8-.10(5) requires the applicant to describe the procedures to be used. The following information should be included:

(1) a description of the instrumentation to be used in evaluating the smears, including its sensitivity and accuracy;

(2) a description of the calibrating and standardizing procedures with a sample calculation showing conversion of results to the required microcurie units. Survey instruments are generally not designed for such measurements and may not be acceptable for this use;

(3) a description of the material to be used in taking the smear, the points on the equipment that will be smeared (smears are not normally taken directly from the surface of a source; see SRPAR 1200-2-8-.04(5)(c)).

(4) the radiation safety procedures to be followed during the smearing process, the method for handling and disposing of the smears; and

(5) a description of the pertinent training and experience of each person who will take or evaluate the smears.

Distributors, of sealed sources usually supply a certificate with each source giving the results and date of the last leak test performed on a source. If such a certificate is not received, the source may not be used until a leak test has been performed and the results of the test showing that the source is not leaking or contaminated have been received. Thereafter, the source must be tested for leakage and contamination at intervals not to exceed 6 months. Records of the testing identifying each source tested, the date of the test, and the results of the test in units of microcuries must be maintained for State inspection.

Item 6(j). The applicant should submit an inspection and maintenance program for radiographic exposure devices, source changes, and storage containers.

a. The licensee shall check for obvious defects in radiographic exposure devices, storage containers and source changes prior to use each day the equipment is used.

b. The licensee shall conduct a program for inspection and maintenance of radiographic exposure devices, source changers, and storage containers at intervals not to exceed three (3) months or prior to the first use thereafter to assure proper functioning of components important to safety. Records of these inspections and maintenance shall be kept for inspection by the Department.

AMENDMENTS TO LICENSES

Licensees are required to conduct their programs in accordance with statements, representations, and procedures contained in the license application and supportive documents and in the conditions of the license. The license must therefore be amended if the licensee plans to make any changes in facilities, equipment (including monitoring and survey instruments), procedures, personnel, or byproduct material to be used.

Applications for license amendments may be filed in letter form. The letter should identify the license by number and should clearly describe the exact nature of the requested changes, additions, or deletions. References to previously submitted information and documents should be clear and specific and should identify the pertinent information by date, page, and paragraph.

RENEWAL OF A LICENSE

Radioactive material licenses are issued for a period not exceeding ten years.

An application for renewal of a license should be filed at least 30 days prior to the expiration date as provided for in SRPAR 1200-2-10-.18(2). This will ensure that the license does not expire until final action on the application has been taken.

Renewal applications must be filed on Form RHS 8-5R appropriately supplemented and should contain complete and up-to-date information about the applicant's current program.

In order to facilitate the review process, the application for renewal may reference previously submitted documents and information.

APPENDIX A
CALIBRATION OF INSTRUMENTS

1. Sealed source(s) used for calibrating of survey instruments should:

   a. Approximate a point source

   b. Have its exposure rate at a given distance traceable by documented measurements to a standard certified to be within +/- 5% accuracy by NIST

   c. Approximate the same photon energy (Ir-192, Co-60) as the source to be used in the radiography device.

   d. Be of sufficient strength to give an exposure rate of about 0.3 mSv/hr (30 mrem/hr) at 100 cm. (85 millicuries of Cs-137 or 21 millicuries of Co-60)

2. Use the inverse square law and radioactive decay law to correct changes in exposure rate due to source decay or different distances from the source.

3. Record survey meter calibration data and maintain written records for each instrument being used to satisfy regulatory requirements. Survey meter calibration reports should contain the following information and must be maintained 3 years from date of calibration of each instrument:

   a. Owner or user identification, including name, address, and person to be contacted

   b. Instrument description that includes manufacturer, model number, serial number, and type of detector

   c. Calibration source description that includes exposure rate, indicated exposure rate at a specified distance on a specified date, and the calibration procedure

   d. Each calibration point identifying the calculated exposure rate, the indicated exposure rate, the deduced correction factor, and the scale selected on the instrument

   e. Exposure reading indicated with the instrument in the "battery check" mode, if available

   f. Angle between the radiation flux field and the detector (parallel, perpendicular)

Note: Internal detectors should specify angle between radiation flux field and a specified surface of the instrument.

   g. For detectors with removable shielding, note whether the shielding was in place or removed during the calibration procedure.

h. Include person's name who performed the calibration and the date on which the calibration was performed

4. A single point on a survey meter scale can be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10%.

Note: Three kinds of scales are frequently used on radiation survey meters:

a. Linear Scale: Meters on which the user selects a linear scale must be calibrated at no less than two points on each scale. The points should be at approximately 1/3 and 2/3 of the decade.

b. Multidecade Logarithmic Scale: Meters that have a multidecade logarithmic scale must be calibrated at no less than one point on each decade and no less than two points on one of the decades. These points should be approximately 1/3 and 2/3 of the decade.

c. Automatically Ranging Digital Display: Meters that have a device for indicating rates must be calibrated at no less than one point on each decade and no less than two points on one of the decades. These points should be approximately 1/3 and 2/3 of the decade.

5. Scales in excess of 10 mSv/hr (1,000 mrem/hr) need not be calibrated. However, such scales should be checked for operation and approximately correct response.

6. The following information should be attached to the instrument as a calibration sticker or tag:

a. Source that was used to calibrate the instrument

b. A calibration chart or graph for each scale or decade of a survey meter that is greater than +/- 20% of the actual values identifying the average correction factor, or a note indicating that scale was checked only for function or is inoperative.

c. Date of calibration

d. Date survey instrument is due calibration

e. Name or initials of individual calibrating instrument

Inverse Square Law

If R_a is the exposure rate at a distance D_a from a point source and R_b is the exposure rate at a distance D_b from the same point source, then
$R_a D^2_a = R_b D^2_b$

Note: R_a and R_b must be in the same units of exposure rate (e.g., mR/hour, R/hour, etc.) and D_a and D_b must be in the same units of distance (e.g., centimeters, meters, etc.).

If R_a, D_a, and D_b are known, R_b can be calculated from

$$R_b = \frac{D^2_a}{D^2_b} \times R_a$$

Radioactive Decay Law

The exposure rate of a standard source at a time after a specified calibration date is given by

$$R_t = R_o \times e^{-(0.693\, t / T_{1/2})}$$

where

R_t is the exposure rate at a time t after the source calibration date
R_o is the exposure rate on the day of calibration
t is the time elapsed since the calibration date
$T_{1/2}$ is the radionuclide half-life

Note: R_t and R_o must be in the same units of exposure rate (e.g., mR/hour, R/hour, etc.) and t and $T_{1/2}$ must be in the same units of time (e.g., seconds, days, years, etc.).

APPENDIX B
OPERATING AND EMERGENCY PROCEDURES

SRPAR 1200-2-8-.05(2) requires each licensee to provide radiography personnel with operating and emergency procedures. The purpose of this requirement is to provide radiography personnel with clear and specific instructions in the topics listed in SRPAR 1200-2-8-.07 and in other duties and responsibilities that radiography personnel may have. Other duties could include instrument calibration, leak testing, quarterly inspection and preventive maintenance of equipment, and shipment of sources and devices. The operating and emergency procedures for personnel should not contain information that does not apply specifically to the duties of radiography personnel; for example, neither the training program nor the management control program should be included in the operating and emergency procedures.

The operating and emergency procedures should be tailored to fit the program proposed in the application. The procedures and instructions should be complete and self-contained in a single document or in a clearly designated part of a broader scope document that includes related material such as a description of the management control program. Information contained in equipment manuals and other publications should be extracted and inserted into the operating and emergency procedures so that the instructions to personnel are clear, specific, and appropriate for the proposed program. Where applicable, instructions for use and handling of devices incorporated into permanent radiographic installations should be separate and distinct from those for mobile or portable devices.

There is no specific format for operating and emergency procedures. However, a sequential set of instructions that covers radiography operations from the beginning of the workday to the end of the workday is an acceptable format. Topics that should be included in the operating and emergency procedures are:

a. Handling and Use of Licensed Sealed Sources, Radiographic Exposure Devices, Source Exchangers, and Instrument Calibration Equipment.

(1) Step-by-step instructions for the use and handling of radiographic exposure devices and related equipment should be provided. When appropriate, the procedures should include instructions for use of radiation collimating cones or other auxiliary shielding material.

(2) If source exchange will be performed by radiography personnel, step-by-step instructions for source exchange, including surveys to be performed during the source exchange and for shipment and acceptable radiation levels for these surveys, should be in the procedures. Such instruction should, also, state the steps to be taken if the survey levels exceed acceptable limits.

(3) If radiography personnel will perform instrument calibration, step-by-step instructions should be in the procedures and in item 6.c.

(4) If radiography personnel will perform leak testing of sealed sources, specific instructions for performing the leak test should be in the procedures and in item 6.i. If the applicant will use commercially available leak test kits, the instructions and procedures provided by the kit suppliers should be modified to the applicant's program. For example, many kit procedures indicate that the manufacturer of the source should be notified if a survey of the leak test sample indicates a potentially leaking source. Instructions should indicate that management will be informed since dealing with suppliers is usually a management function.

b. Methods and Occasions for Conducting Radiation Surveys.

The procedures should identify when-surveys should be made, specifically what should be surveyed, acceptable radiation levels for the surveys, the steps to be taken if acceptable levels are exceeded, and records of survey results to be made. In general, a survey should be performed each time a source is manipulated or moved. Surveys that need to be performed include:

(1) Determination after each exposure that the source has returned to the safe storage position. The entire circumference of the radiographic device must be surveyed. If the radiographic exposure device has a source guide tube, the survey should include the guide tube.

(2) Determination of the boundary of the restricted area.

(3) Determination of radiation levels at external surfaces of storage facilities.

(4) Determination of radiation levels in and around vehicles used for transporting or storing sources and devices.

(5) Determination that the source is in a safe storage position prior to securing a radiographic exposure or storage container.

(6) Determination of the number of radiographic exposures and the duration of each.

(7) Determination that containers prepared for shipment comply with the requirements in Department of Transportation regulations (10 mR/hr at 1 meter from any surface and 200 mR/hr at the surface of the container).

The acceptable radiation levels for surveys should be expressed in milliroentgens per hour.

SRPAR 1200-2-8-.06(3)(c) and (d) require that records be maintained of specific surveys. Judgment is required for maintaining records of other surveys required by the regulations in which maintenance of the records is not specified in the regulations. The State does not expect radiographers to record each and every reading taken during a survey. However, records should be complete enough to show clearly that proper surveys have been done.

c. Methods for Controlling Access to Radiographic Areas.

Instructions for controlling access to radiographic areas should be specifically stated in the procedures.

The boundaries of restricted areas and high radiation areas are required to be posted. "Caution[1] Radiation Area" signs should be posted at the boundary of the restricted area, and "Caution[1] High Radiation Area" signs should be posted at the boundary of the high radiation area. High radiation area signs should not be used at the boundary of a restricted area; these signs should be used only at the boundary of a high radiation area.

Signs, by themselves, do not provide an adequate means of access control. For radiographic operations performed outside a permanent radiographic installation, instructions requiring surveillance of the area to prevent unauthorized persons from entering the area are necessary. For permanent radiographic installations, specific instructions concerning use of interlocking devices and systems, locking of the facility, security of keys, use of warning lights and alarms, etc., should be included in the procedures.

The instructions for control of access to permanent radiographic installations should be separate and distinct from the instructions for temporary site operations.

A specification of a radiation level of 2 milliem per hour for the boundary of the restricted area and 100 millirem per hour for the boundary of the high radiation area is acceptable. A physical survey with a survey meter should be performed to confirm the 2 millirem per hour radiation level for the restricted area boundary after the source has been exposed. It is neither necessary nor desirable for a physical survey to be made to confirm the radiation level at the boundary of the high radiation area since such a survey could lead to unnecessary exposure of personnel.

d. Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources.

Instructions requiring securing of the exposure device after completion of the survey to determine that the source has returned to the safe storage position should be written and available. Instructions should further specify that surveys to determine that the sealed source has returned to the shielded position after an exposure are required pursuant to SRPAR 1200-2-8-.06(3)(b) and, in the case of a radiographer's assistant, they must be made under the personal supervision of a radiographer, SRPAR 1200-2-8-.03(17). SRPAR 1200-2-8-.06(3)(c) requires that a record of the last survey made prior to locking the radiographic exposure device and ending direct surveillance be maintained.

[1] **Or Danger**

Instructions and procedures for storage of sources and devices at both permanent and temporary job sites, including locking of devices, posting of storage area, and surveys around the storage areas, should be in the procedures. The area outside storage areas should meet the requirements for an unrestricted area.

e. Personnel Monitoring and the Use of Personnel Monitoring Equipment.

The instructions should contain requirements for radiography personnel to wear their personnel monitoring devices so that any exposure received will be accurately reflected by the devices. The instructions should be specific. See SRPAR 1200-2-8-.05(3) for personnel monitoring control requirements. The use of optically stimulated luminescent dosimetry is acceptable.

Frequent reading of pocket dosimeters should be required so that personnel may be aware of exposure that they may have received. An instruction concerning steps that must be taken immediately by radiography personnel in the event a dosimeter is found to be off scale should be included in the procedures. This instruction should include the requirement stated in paragraph SRPAR 1200-2-8-.05(3)(d) that an individuals film badge or TLD be processed immediately if that individuals pocket dosimeter is discharged beyond its range. It should be required that the individual cannot return to work with radioactive material until a determination of his radiation exposure has been made. Instructions for storage of personnel monitoring devices should be included in the procedures.

f. Transporting Sealed Sources to Field Locations, Packaging of Exposure Devices and Storage Containers in the Vehicles, Posting of Vehicles, and Control of Sealed Sources During Transportation.

Most transport of radiography sources in exposure devices or storage containers over public roads is subject to the regulations of the Department of Transportation. These regulations cover, among other things, permissible radiation levels around and within a vehicle and placarding of the vehicle during transport. Even in those cases in which the Department of Transportation regulations are not applicable (such as intrastate transportation), SRPAR 1200-2-10-.30 requires conformance to the standards and requirements of the Department of Transportation. This includes shipping papers for everyday transport.

The procedures should contain instructions on how exposure devices or storage containers will be secured within the transporting vehicle to prevent shifting within the vehicle. There should be instructions for placarding of the vehicle during transport. The Department of Transportation regulations require "RADIOACTIVE" placards on all four sides of the vehicle for Type Yellow III packages. There should be instructions for surveys in and around the vehicle. The radiation level in the passenger compartment should not exceed 2 millirem per hour. Although it is not specifically required for transport, there are occasions when the vehicle should be considered an unrestricted area so that a specification of a radiation level of 2 milliroentgens per hour at a distance of 12 inches from any external surface of the vehicle should be provided.

When a vehicle is used for storage, i.e., when the sources are not being transported, the posting requirements in SRPAR 1200-2-5-.111 are applicable, and that vehicle should therefore be posted with "Caution-Radioactive Material" signs. As noted above, the area outside a parked vehicle used for storage is an unrestricted area, and the radiation level at 12 inches from the surface of the vehicle should not exceed 2 millirem per hour.

g. Minimizing Exposure of Persons in the Event of an Accident.

Instructions to personnel should include procedures for minimizing the exposure of persons in the event of an accident or other unusual occurrence. Possible malfunctions of equipment should be considered, and steps to follow in each case of malfunction should be specifically set forth.

The procedures should contain clear and specific instructions concerning emergency situations. The steps to be taken by radiography personnel should, in general, be limited to (1) surveying the area, (2) establishing a restricted area, (3) notifying appropriate persons, and (4) maintaining direct surveillance and control over the area until the situation is corrected. Limitations on action that may be taken by radiography personnel should be clearly specified.

The attempted recovery of a source that has become detached from an exposure device, an operation that may result in exposure to high levels of radiation, should not be attempted by radiography personnel unless specifically trained. Submit source retrieval procedures and specific training for radiography personnel if you wish to be authorized for source retrieval. If not, confirm that source retrievals will only be performed by a person specifically licensed by the NRC or an Agreement State to perform such services.

h. Procedure for Notifying Proper Persons in the Event of an Accident.

The names and telephone numbers of the persons to be contacted should be specified.

i. Recordkeeping.

The instructions to personnel should specify those records that must be maintained by them during the course of their work. Among the records that are normally made by radiography personnel are dosimeter readings, surveys, and daily inspection of equipment. Other records should be included if they are the responsibility of radiography personnel. Records for which management and supervisory personnel have responsibility should not be included in the operating and emergency procedures.

j. Inspection and Maintenance of Radiography Exposure Devices, Storage Containers, and Source Changers.

SRPAR 1200-2-8-.04(8) requires a check for obvious defects in radiographic exposure devices, storage containers, and source changers. This should be done prior to use each day the equipment is used. The procedures should contain specific instructions for inspection of equipment and the actions to be taken if any defects are found. A checklist should be contained in the procedures, listing the items that should be covered in the daily inspection. Equipment manufacturers may be helpful in providing information concerning daily inspections.

Inspection and preventive maintenance of equipment at intervals not to exceed three months prior to the first use thereafter should also be done. If radiography personnel will conduct these inspections, the procedures should contain clear and specific instructions for inspection and maintenance. As part of the inspection and preventive maintenance program, all connectors, drive cable, source guide tubes, on-off indicator mechanisms, and moving parts should be checked for defects and excessive wear. Cables should be cleaned and lubricated, and all defective and excessively worn components repaired or
replaced. if components essential to the safe operation of the device are found to be defective or in poor operating condition, the device should be immediately removed from service until repairs can be made. An instruction to be followed in this event should be written. Records of quarterly inspections and maintenance must be kept for three years.

Visible and audible warning systems used in a permanent radiographic installation should be tested and records made thereof at intervals not to exceed three months. Other area safeguards, which may include door and equipment interlocks of access-door locking devices, should be tested for proper operation at least once every six months. The procedures should contain instructions for performing such inspections if they are to be performed by radiography personnel.

k. Off-Scale Pocket Dosimeter Readings.

Procedures to be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off scale should include the following instructions:

(1) Stop work immediately;

(2) Initiate emergency procedures if the source is exposed and cannot be retraced; otherwise, retract the source safely;

(3) Notify the radiation safety officer immediately. In this regard the name of the radiation safety officer and the manner in which this individual can be reached should be included.

l. Product Malfunctions and Defects.

If the radiographer discovers any malfunction or defect in the equipment, the radiographer should notify the radiation safety officer. Procedures to be followed in such an event should tell the radiographer what to report, when to report the problem, and the individual to whom it should be reported.

APPENDIX C
TRAINING PROGRAM

An applicant for a radiography license is required to have an adequate program for the training of radiographers and radiographer's assistants. With respect to radiography personnel, two important points should be understood: (1) the duties and responsibilities of the radiographer may not be delegated to the radiographer's assistant. A radiographer must be physically present at the location where radiography is being performed. A radiographer's assistant may perform source manipulation, surveys of the radiographic device to determine source locations etc., only in the physical presence of a radiographer, and (2) any individual who assists a radiographer by manipulating radiographic exposure devices, sealed sources, related handling tools, or survey instruments is acting in the capacity of a radiographer's assistant and must meet the requirements of SRPAR 1200-2-8-.05(l)(b). Below is an outline of the training program required by the regulations (SRPAR)

Radiographers

Initial training (required to be performed, or can accept resumes of prior training and experience per 1200-2-8-.10(a)2; submit training program or resumes for DRH review except not _required to be submitted for certified radiographers or after 6/30/02 when certification becomes required)

Subjects in SRPAR 1200-8-.07 (should be approximately 40 classroom hours at least 4 of which should be on equipment)

1. Fundamentals of radiation safety, including

    a. characteristics of gamma radiation

    b. units of radiation dose and quantity of radioactivity

    c. hazards of radiation dose and quantity of radioactivity

    d. levels of radiation from sources to be used

    e. methods of controlling radiation dose and exposure

        i. working time

        ii. working distance

        iii. shielding

f. radiation detection instrumentation to be used, including

i. use of radiation safety instruments

operation

calibration

limitations

ii. survey techniques

iii. use of personnel monitoring equipment

film badges, thermo or optically stimulated luminescent dosimeters

pocket dosimeters

alarm ratemeters

g. Radiographic equipment to be used

i. operation and control of radiographic exposure equipment, remote handling equipment and storage containers, including pictures or models of source assemblies (pigtails)

ii. storage, control, and disposal of licensed material

iii. inspection and maintenance of equipment

h. The requirements of pertinent state regulations

i. The licensee's written operating and emergency procedures

j. Case history of radiography accidents

The radiographer shall successfully complete a written test and a field examination in the above subjects. Examples of this test with the correct answers and an outline of the field exam shall be submitted to DRH for approval. The written test should include at least 50 questions that cover all areas of instruction. It should be confirmed that a passing grade is 80%.The field exam shall examine the demonstration of competence to use sources of radiation, related handling tools, and survey instruments.

A minimum of two months of on the job training (under the supervision of a certified radiographer; submit content to DRH)

Instruction in: (approximately 8 hours; submit content to DRH)

Chapters 1200-2-5, 1200-2-8, and 1200-2-10 of SRPAR

Applicable U.S. DOT regulations as referenced in 10 CFR Part 71

License conditions

Operating and Emergency Procedures

Submit the means to be used by the licensee to determine the radiographer's knowledge and understanding of and ability to comply with Division regulations, licensing requirements, and operating and emergency procedures. A written or oral test with at least 50 questions and a passing grade of 80% is expected.

Periodic training (shall be at least annual; submit to DRH)

iv. Review the following radiation safety aspects of industrial radiography

new procedures or equipment

new or revised regulations

opportunities for employees to ask safety questions and receive answers to their safety questions

the results of internal inspections

accidents or errors that have been observed

Radiographer's Assistants

Instruction in: (approximately 8 hours for regulations, license conditions, and procedures; approximately 4 hours for devices, sources, equipment, and survey instruments; submit content to DRH)

Chapters 1200-2-5, 1200-2-8, and 1200-2-10 of SRPAR

Applicable U.S. DOT regulations as referenced in 10 CFR Part 71

License conditions

Operating and Emergency Procedures

The use of radiographic exposure devices, sealed sources, associated equipment, and radiation survey instruments

Submit the means to be used by the licensee to determine the radiographer's assistant's knowledge and understanding of and ability to comply with Division regulations, licensing requirements, and operating and emergency procedures. A written or oral test with 20-50 questions and a passing grade of 80% is expected. Submit the means used by the licensee to demonstrate competence in the use of devices, sources, equipment, and survey instruments.

Periodic training (shall be at least annual; submit to DRH)

v. Same as outlined above for radiographers

APPENDIX D
PROGRAM RESPONSIBILITIES AND MANAGER OUALIFICATIONS

The individual assigned the duties of maintaining active management control of the program must be a qualified radiographer and have one year of full time hands-on experience as a qualified radiographer, and have training in establishing and maintaining a radiation protection program. They shall have training in the use of the types of equipment proposed in the application and shall bear the title of Radiation Safety Officer. Thorough knowledge of management policies, company administrative and operating procedures, and safety procedures related to protection against radiation exposure should be prerequisites for the position. Alternates who are approved radiographers should be designated to assume these functions when necessary.

A list of the duties that may be performed by the licensee's management personnel is presented below. It is not intended to be all-inclusive nor should it be interpreted as a requirement that any one person assume all of the listed duties. Some duties may be delegated to persons of lesser authority.

1. Serving as the licensee's liaison officer with the Division of Radiological Health on license matters.

2. Maintaining control of procurement, security, and disposal of licensed material.

3. Developing and maintaining up-to-date operating and emergency procedures.

4. Establishing and maintaining a personnel monitoring program.

5. Procuring and maintaining radiation survey instruments.

6. Establishing and conducting the training program for radiographers and radiographer's assistants.

7. Examining and determining competence of radiographic personnel.

8. Establishing and maintaining storage facilities.

9. Maintaining exposure devices, radiography facilities, and associated equipment.

10. Establishing and maintaining a leak testing program.

11. Establishing and maintaining the internal inspection system.

12. Performing source replacement and source tagging operations.

13. Conducting quarterly inventories and maintaining utilization logs.

14. Establishing and conducting a survey instrument calibration program.

15. Establishing and maintaining the licensee's recordkeeping system.

16. Reviewing and ensuring maintenance of those records kept by others.

17. Assuming control and instituting corrective action in emergency situations.

18. Investigating the cause of incidents and determining necessary preventive action.

19. Acting in an advisory capacity to the licensee's management and radiography personnel.

20. Establishing a procedure for evaluating and reporting defects and noncompliance.

21. Stopping unsafe licensed activities.